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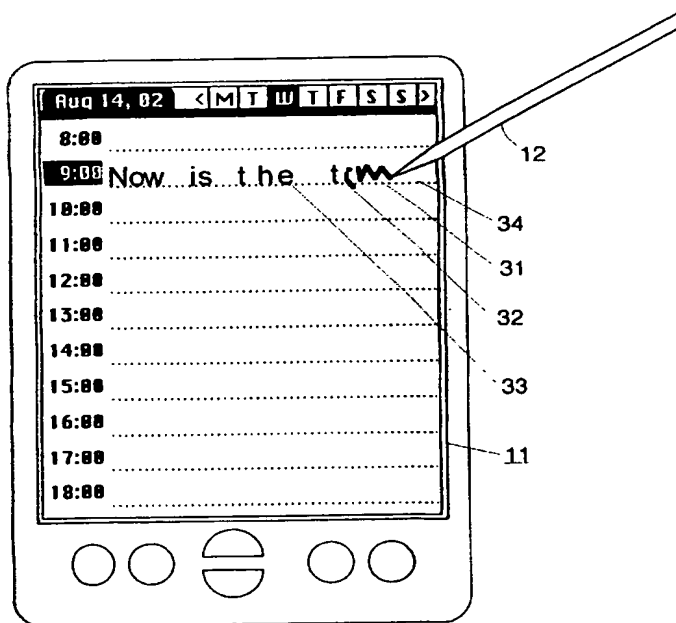
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(54) Title: METHOD OF COMBINING DATA ENTRY OF HANDWRITTEN SYMBOLS WITH DISPLAYED CHARACTER DATA



(57) Abstract: A pen (12) or stylus-operated graphical user interface for a computer (10) or computing device, which includes a sensing surface (11) having an area corresponding to a data input field, the data input field being conditioned for hand entering and editing of graphical input symbols (13), and user recognition software operative to analyze the graphical input symbols (13) and superimposing a display field of character data (32) corresponding to the graphical input symbols on the data input field.

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METHOD OF COMBINING DATA ENTRY OF HANDWRITTEN**SYMBOLS WITH DISPLAYED CHARACTER DATA****FIELD**

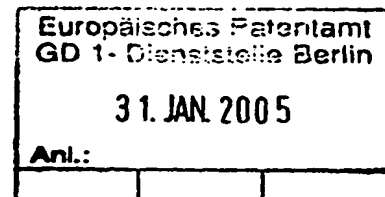
The present invention relates to a method for combining data entry produced with
 5 a stylus on a sensing surface such as a computer touch screen or digitising tablet, with display of
 the character data corresponding to each handwritten symbol. Handwriting recognition software
 is used to produce the character data corresponding to each symbol.

BACKGROUND

10 Systems with handwriting recognition include electronic notebooks and personal
 digital assistants (PDAs), which are portable computers incorporating a touch screen graphics
 display; and also non-portable computer workstations equipped with a digitising tablet and
 graphics display. Both types of systems have a pen input function when the user draws or writes
 with a stylus on the surface of the touch screen or digitising tablet. For handwritten data entry,
 15 such systems utilize a graphical user interface (GUI) presenting two spatially separate visual
 fields on the graphics display: first, a field where text characters are to be inserted by a text
 editing software program into a document (display field), usually showing a cursor to indicate
 the point of insertion for character data; and second, one or more fields (entry fields), where the
 user draws with the stylus to enter handwritten data.

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After recognition and conversion of the handwritten data, the resulting character
 data appear in the display field at the point of insertion indicated by the cursor. In a typical
 design, not only are the entry and display fields spatially separate, but also the position, size,



location, and other features of the character data bear little relation to the appearance of the original handwritten input.

When the stylus is moved outside of an entry field, it typically operates as a pointing device to invoke other functions of the computer, such as editing text contained in the display field, and changing the insertion point in the display field.

Typical prior methods of data entry with a stylus present the following difficulties to the user.

- 1) visual attention must constantly be shifted between the entry and display fields;
- 2) the stylus must be moved repeatedly between the display fields, to perform editing functions, and the entry fields, to continue entering handwritten data;
- 3) the separate entry fields may use as much as one half of the available graphics display area on a small hand-held device such as a PDA, reducing the amount of other information that can be displayed;
- 4) often, users must select the desired writing mode (characters, numbers, punctuation) and may forget which writing mode is currently active, or may enter the wrong type of handwritten symbol in an entry field; and
- 5) in many systems each entry field accepts a single character only, which must be recognized before the system will accept further handwritten data.

U.S. Patent No. 5,528,743 issued to Tou et al. describes a method of inputting information for the purpose of word processing. In word processing displayed text is formatted

into words, sentences and paragraphs. Tou et al. describes a number of calculations based on the spatial relationship of the position of newly entered graphical input symbols to the positions of paragraphs of formatted character data already existing on the display. Displayed character data are formatted into paragraphs, not necessarily superimposed on input symbols. For example, in Figure 3a of Tou et al. the handwritten symbol "three" entered near the right margin is displayed in Fig. 3b near the center of the line. The handwritten input below the existing character data in Fig. 3b is displayed as character data on the line above Fig. 3c, not in the position in which it was entered.

European Patent Publication No. EP 0689124 (Canon) is concerned with recognizing handwritten symbols which are gestures and distinguishing these from other handwritten input, and performing editing and other operations specified by the gestures. The interaction described in the body of the patent, and in their claims, requires several steps with menu prompts for the user to execute a gesture action. In the 'Description of Related Art' Canon states that when handwritten characters are input to arbitrary positions, recognition processing for the characters is performed and the recognition results are displayed at the positions where the handwriting input operation was performed. However, it is not disclosed whether a user must wait after writing each character until the system analyses and prints out that character or carries out the command operation represented by that character before writing the next character. It is also not disclosed whether or not the recognized input characters are superimposed on the handwritten input characters or are merely placed near them.

U.S. Patent No. 5276794 issued to Lamb describes the handwritten entry into a single-line field based on the position where the handwriting is initiated, or in the field that is

active, even if some or all of the handwriting falls outside the display field. Character data are displayed left-justified in the single-line field, regardless of location of the handwritten input. For example, in Fig. 2a the four symbols "FRED" are entered in the right half of the input field, but the recognition is displayed near the margin (see Fig. 2b). In addition, the recognition and display data are not immediate, but triggered by a time-out or other strategy to determine when the user has completed the input for a field.

U.S. Patent No. 5,220,649 issued to Forcier describes a system in which handwritten input is displayed as "digital ink" (i.e., not automatically recognized and converted to character data) and editing mode is initiated with a timeout.

Accordingly, it is an object of the present invention to provide an improved means of data entry and editing by superimposing the input field and the display field on a GUI. It is a

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further object of the invention to provide an interface in which graphic symbols are entered by the user in an input field, and then are immediately replaced with the symbols' corresponding character data in approximately the same location. It is yet a further object of the invention to provide a means of correcting and editing character data without moving the stylus outside the input field.

SUMMARY OF THE INVENTION

According to the invention there is provided a pen or stylus-operable system for a computer or computing device, which includes a graphical user interface coupled to said computer and having a sensing surface, the sensing surface controlled by the graphical user interface and having means for hand entering and editing of graphical input symbols. Handwriting recognition software on the computer is operative to analyze the graphical input symbols one after another without interruption or delay and to superimpose a display field of character data corresponding to the graphical input symbols on the data input field.

Advantageously, the sensing surface is a display surface. Alternatively, the sensing surface could be a tablet separate from the display surface.

The handwriting recognition software also initiates an action based upon the graphical input symbol. Preferably, the action is an editing mode wherein the pen or stylus contacts the sensing surface without moving for a predetermined minimum amount of time.

Symbol recognition of handwritten input is a default mode and editing mode is initiated with a timeout.

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Preferably movement of the pen, in predefined ways, without being removed from data input field, causes corresponding editing functions to be effected.

The character data may be corrected and edited in the editing mode without moving a cursor for the pen or stylus outside the data input field of the sensing surface.

In another aspect of the invention there is provided a apparatus for combining data entry of handwritten symbols with displayed character data in a pen or stylus-operable graphical user interface for a computer or computing device, which includes means for recording and displaying handwritten graphical input symbols as they are entered on a data input field of a display surface; and handwriting recognition software for analysing continuously, without interruption or delay and automatically superimposing on the display field character data corresponding to the graphical input symbols.

Preferably, the means for recording is a sensing surface operative to receive and record the graphical input symbols. The means for displaying is the display surface or, alternatively may be a part of the display surface.

The handwriting recognition software may initiate an action based upon the graphical input symbol. The action may be an editing mode when the pen or stylus contacts the display surface for a predetermined minimum time without moving.

- 5 Movement of the pen in predefined ways, without being removed from the data input field, may cause corresponding editing functions to be effected.

Character data may be corrected and edited in the editing mode without moving the pen or stylus outside the data input field.

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I CLAIM:

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1. A pen or stylus operable system for a computer, comprising:
 - (a) a graphical user interface coupled to said computer (110, 112, 114) and having a sensing surface (11) said sensing surface having an area corresponding to a data input field (13), said sensing surface controlled by said graphical user interface and having means for hand entering and editing of graphical input symbols (31, 32);
 - (c) handwriting recognition software on said computer operative to analyze said graphical input symbols (31, 32) one after another without interruption or delay and to automatically superimpose on and replace said graphical input symbols with a display field of character data (33) corresponding to said graphical input symbols (31, 32) on said data input field (13).
2. An interface according to claim 1, wherein said sensing surface (112) is a display surface.
3. An interface according to claim 1, wherein said sensing surface (112) is a tablet (11) separate from a display surface.
4. An interface according to claim 1, wherein said handwriting recognition software also initiates an action based upon said graphical input symbol.

5. An interface according to claim 1, wherein said handwriting recognition software initiates an editing mode when said pen or stylus (12) contacts said sensing surface (11) without moving for a predetermined minimum amount of time.
6. An interface according to claim 5, wherein symbol recognition of handwritten input is a default mode and editing mode is initiated with a timeout.
7. An interface according to claim 5, wherein movement of said pen (12), in predefined ways, while being held in continuous contact with the sensing surface, without being removed from said data input field, activates corresponding editing functions.
8. An interface according to claim 7, wherein said character data is corrected and edited in said editing mode without moving a cursor for said pen or stylus (12) outside said data input field of said sensing surface (11).
9. Apparatus for combining data entry of handwritten symbols with displayed character data in a pen or stylus-operable graphical user interface for a computer or computing device, comprising:
- (a) means for recording and displaying handwritten graphical input symbols as they are entered on a data input field of a display surface; and
 - (b) user recognition software for analyzing said graphical input symbols one after another continuously without interruption or delay and automatically

superimposing on and replacing said graphical input symbols (31, 33) with a display field character data corresponding to said graphical input symbols.

10. Apparatus according to claim 9, wherein said means for recording is a sensing surface (11) operative to receive and record the graphical input symbols.

11. Apparatus according to claim 10, wherein said means for displaying is said display surface (112).

12. Apparatus according to claim 10, wherein said sensing surface (112) is at least part of said display surface (112).

13. Apparatus according to claim 9, wherein said handwriting recognition software also initiates an action based upon said graphical input symbol.

14. Apparatus according to claim 9, wherein said handwriting recognition software initiates an editing mode when said pen or stylus (12) contacts said display surface (112) for a predetermined minimum time without moving.

15. Apparatus according to claim 14, wherein movement of said pen, without being removed from said data input field, in predefined ways, while held in continuous contact with the sensing surface, activates corresponding editing functions to be effected.

16. Apparatus according to claim 15, wherein character data is corrected and edited in said editing mode without moving a cursor for said pen or stylus outside said data input field.

16. Apparatus according to claim 15, wherein character data is corrected and edited in said editing mode without moving a cursor for said pen or stylus outside said data input field.

ABSTRACT

A pen or stylus-operated graphical user interface for a computer or computing device, which includes a sensing surface having an area corresponding to a data input field, the data input field being conditioned for hand entering and editing of graphical input symbols, and

5 handwriting recognition software operative to analyze the graphical input symbols and superimposing a display field of character data corresponding to the graphical input symbols on the data input field.

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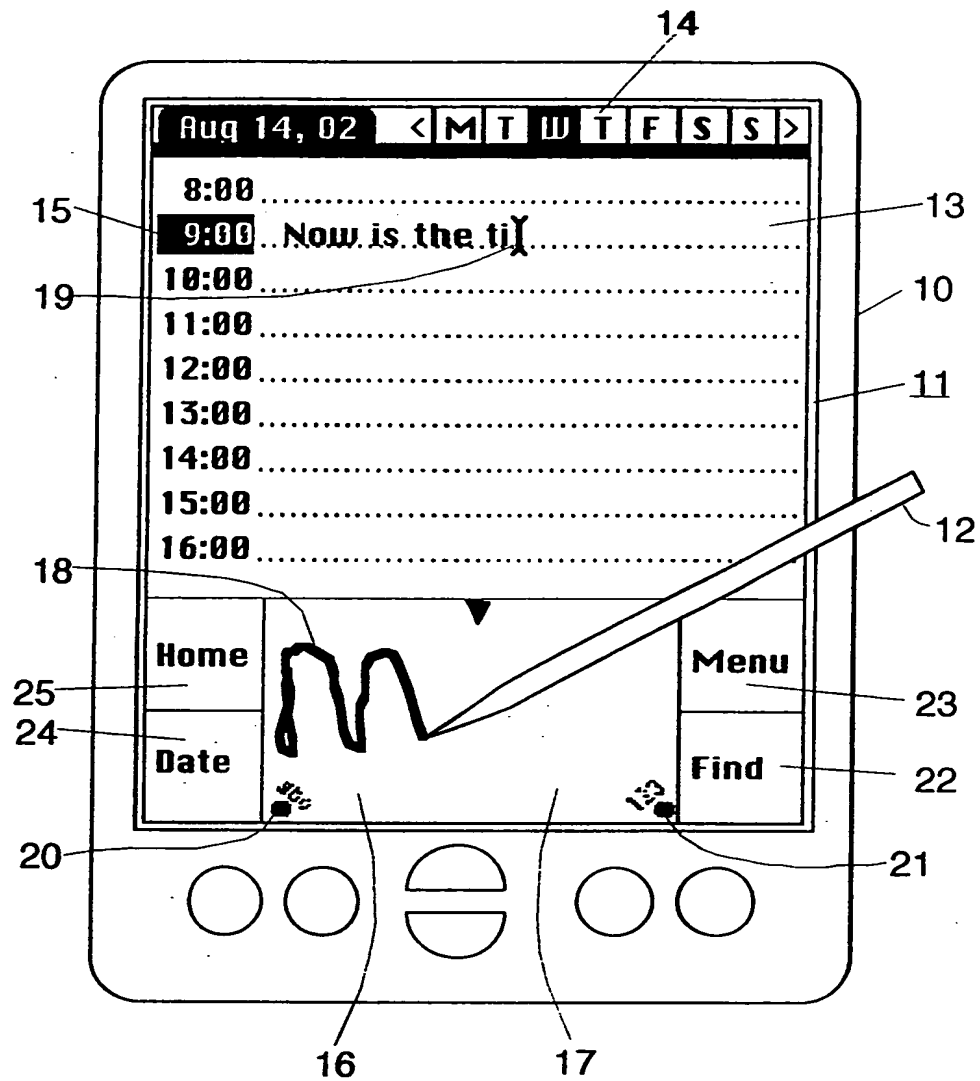


FIG. 1
Prior Art

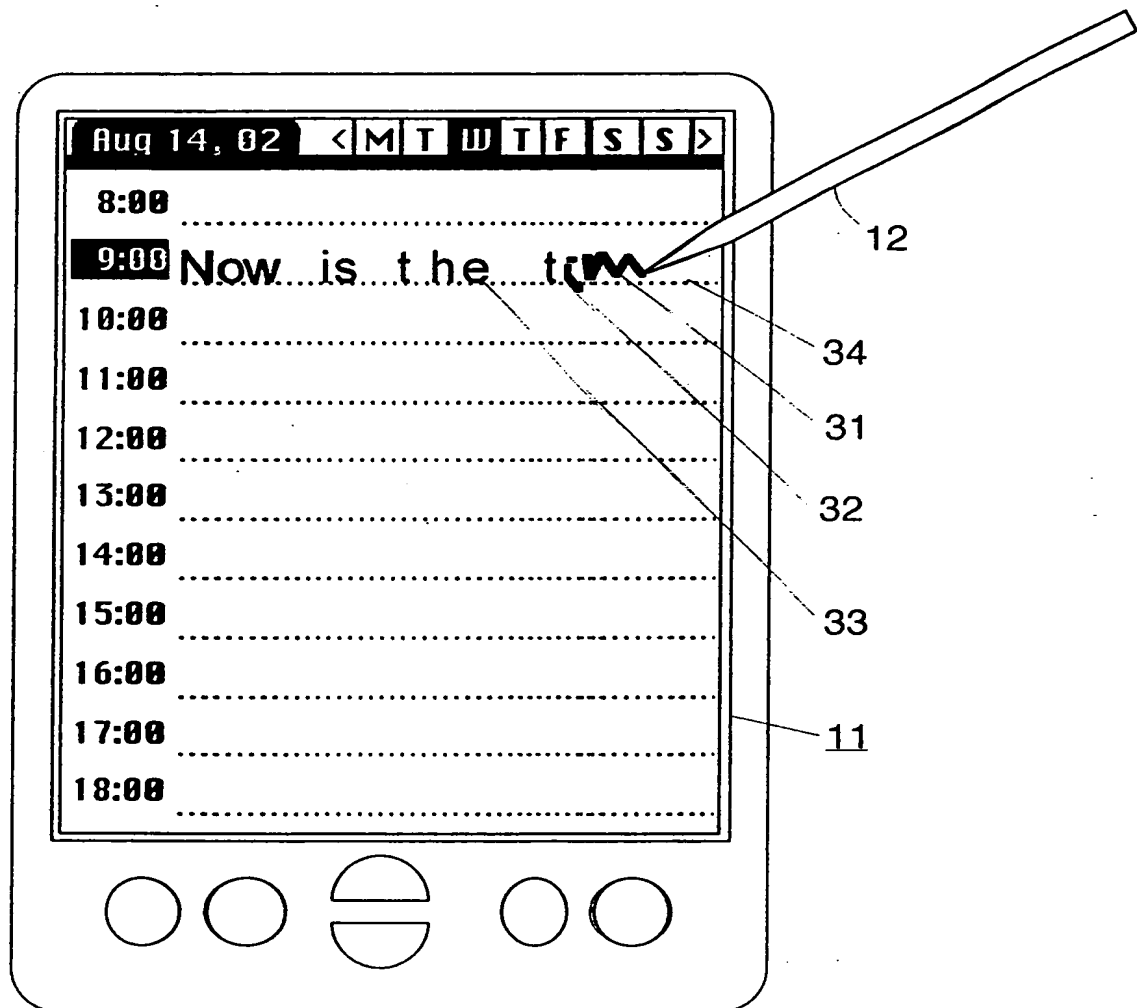


FIG. 2

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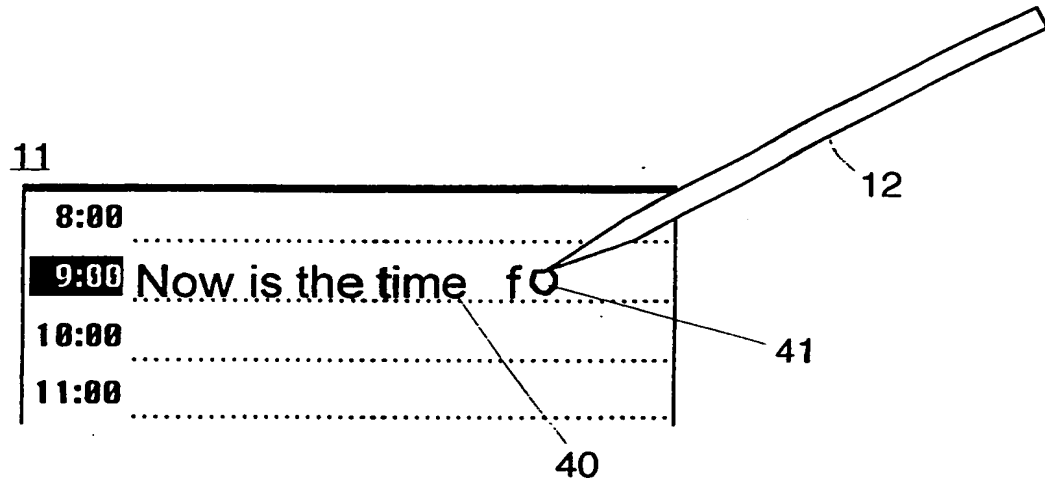


FIG. 3

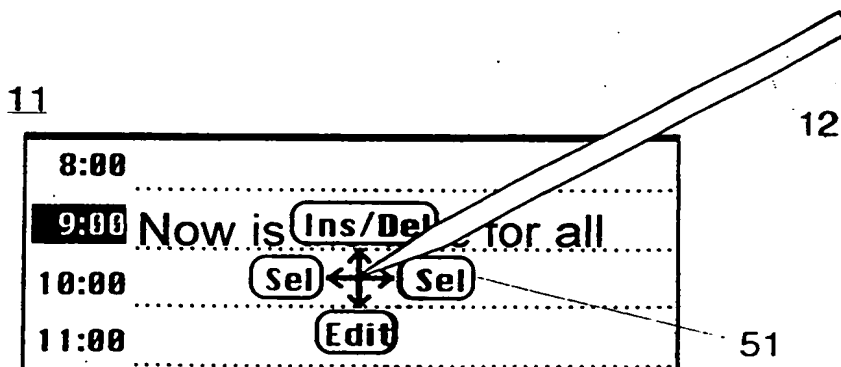
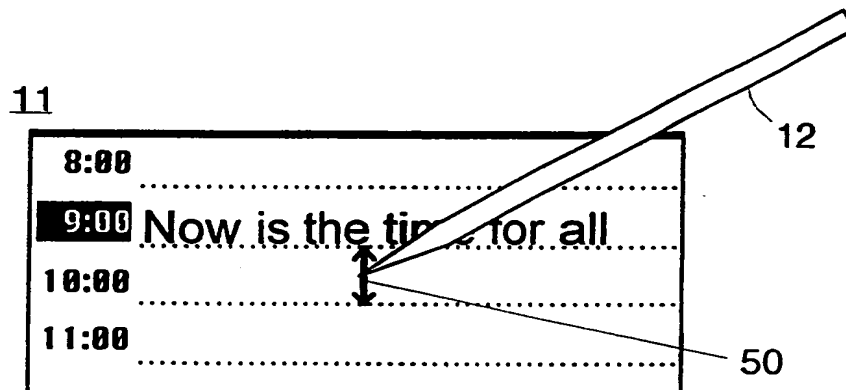


FIG. 4

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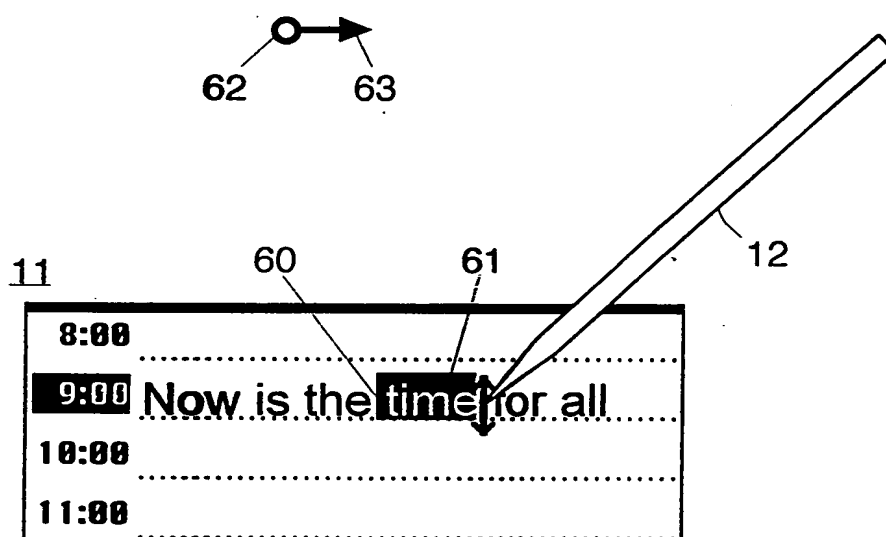


FIG. 5

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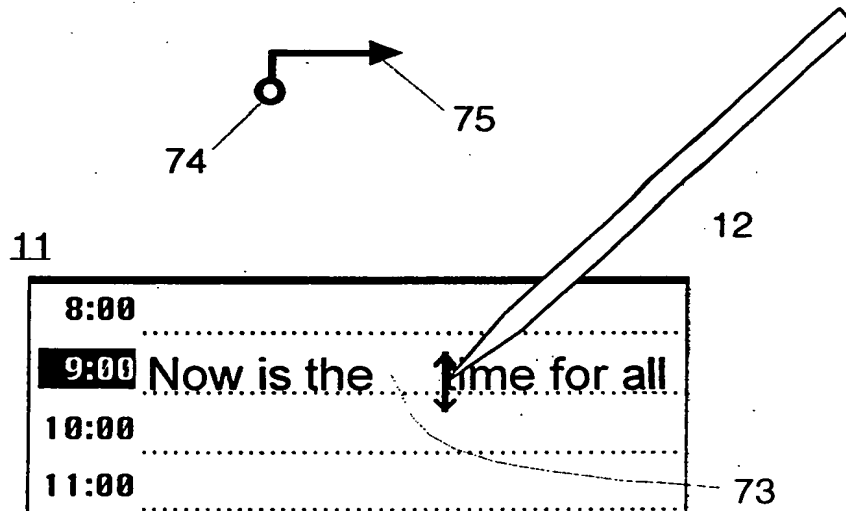
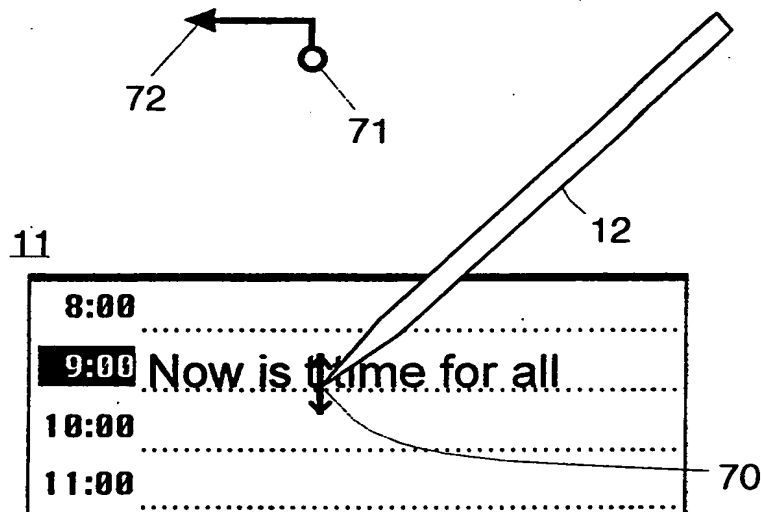


FIG. 6

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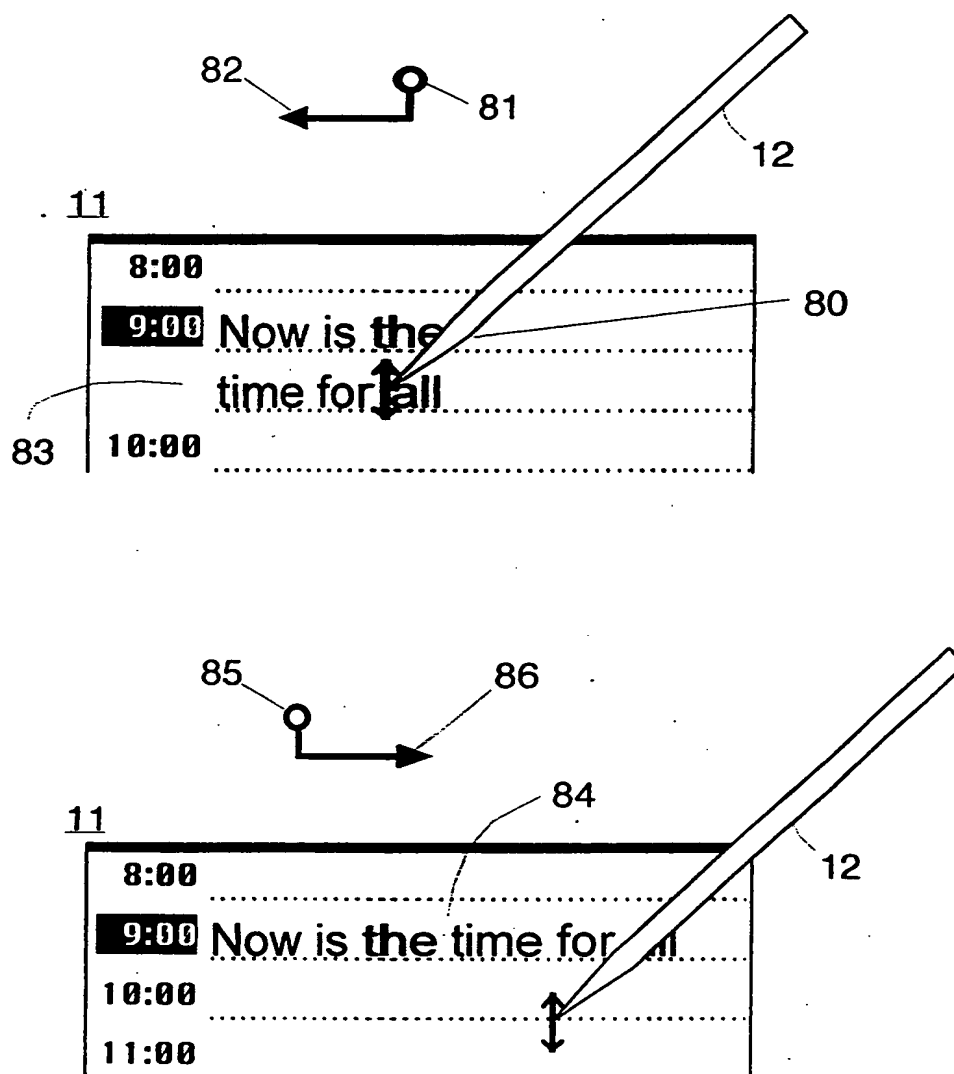


FIG. 7

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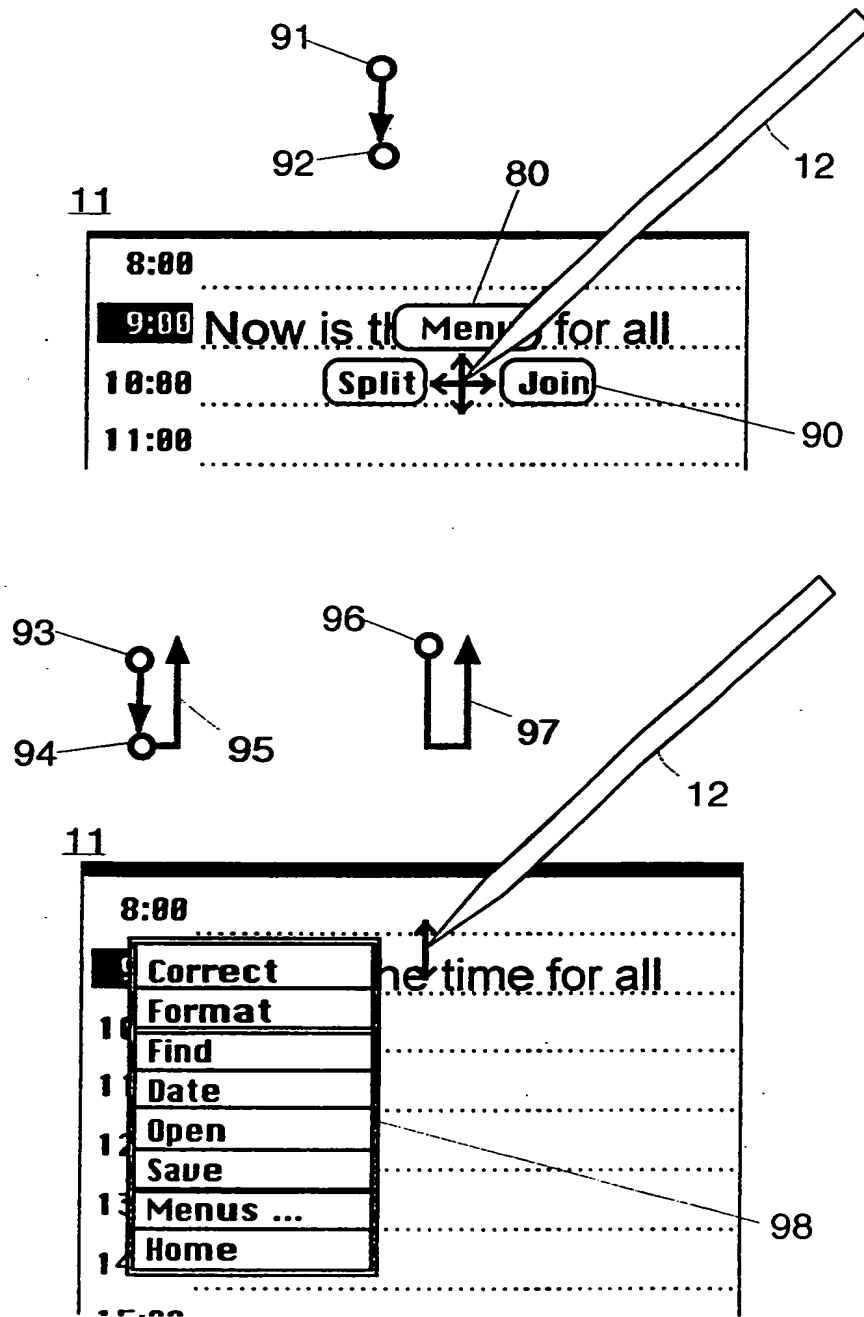


FIG. 8

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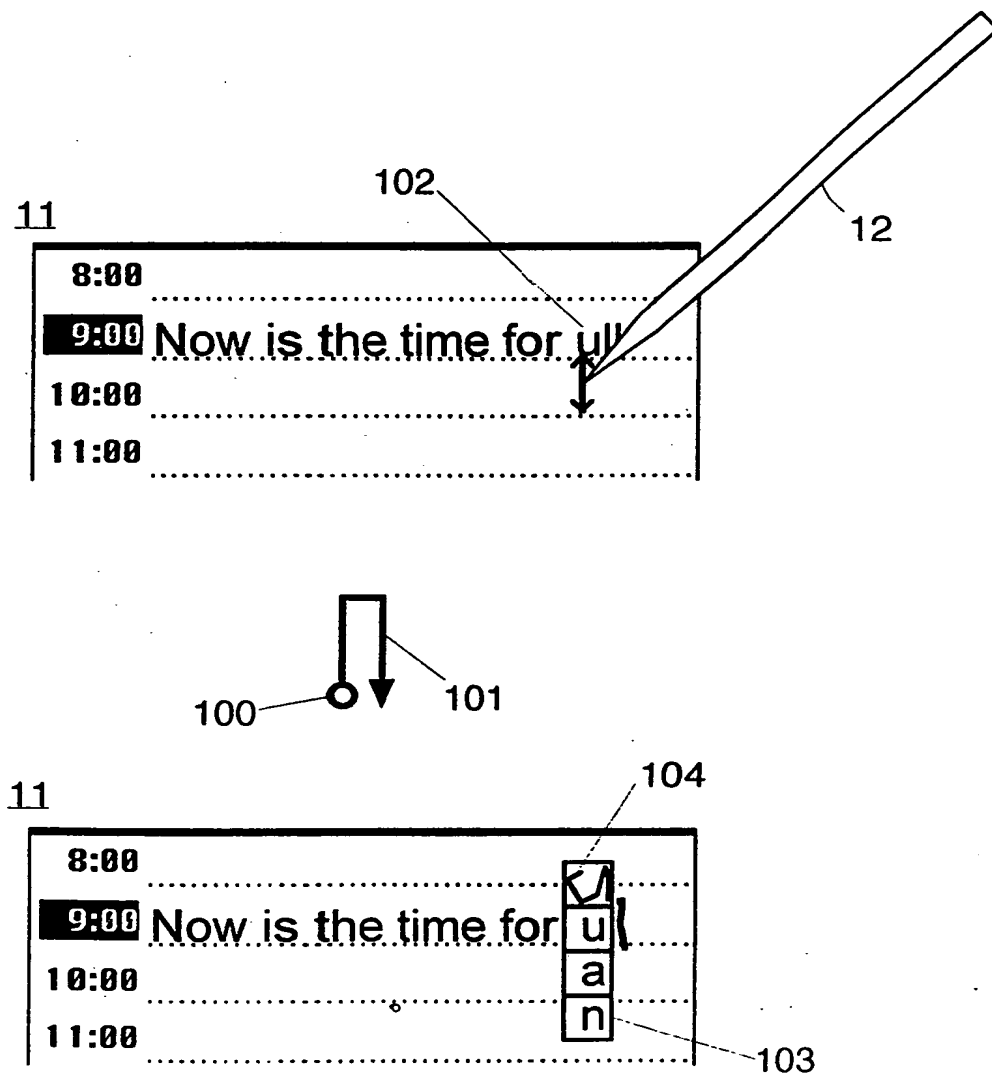


FIG. 9

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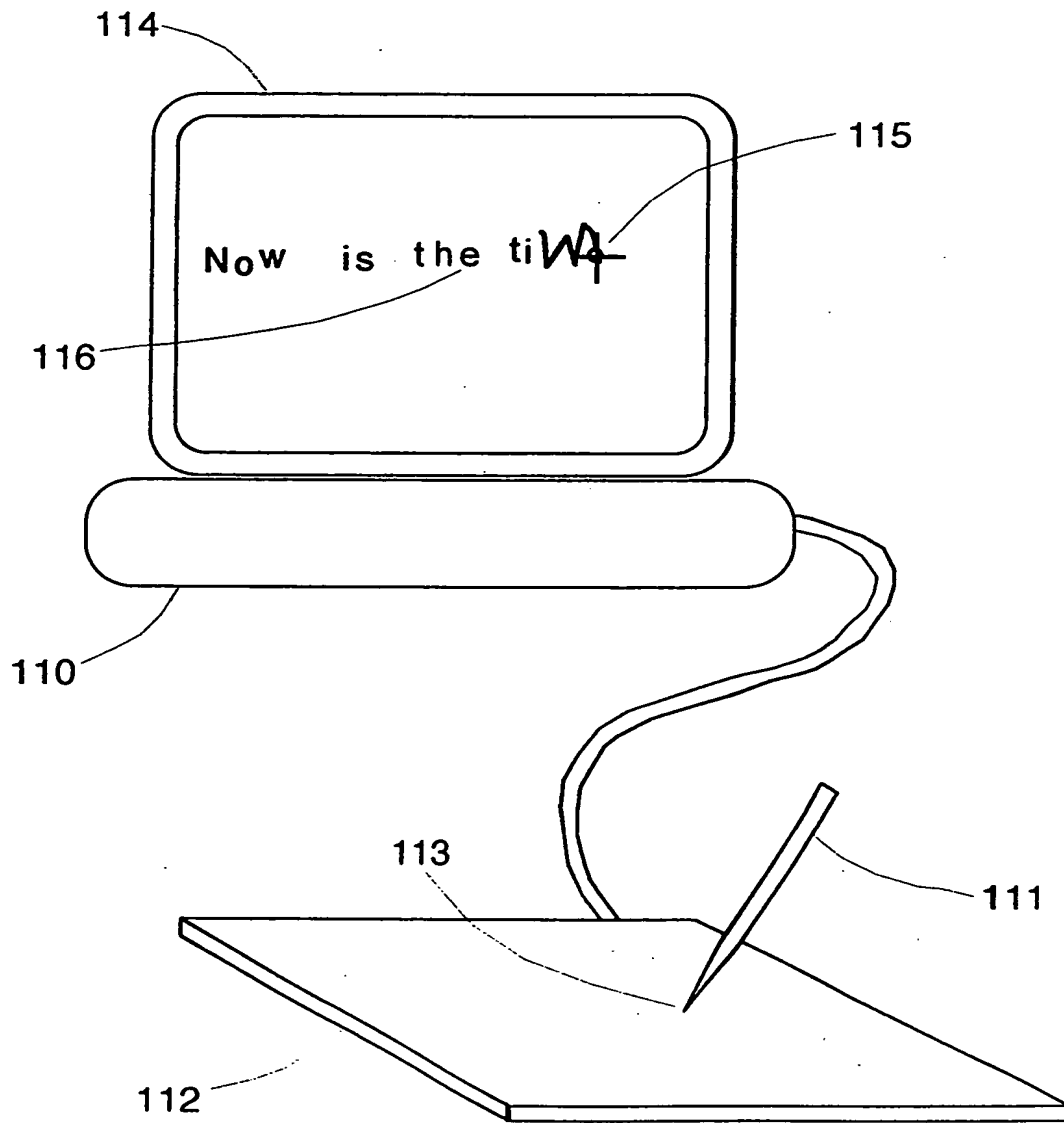


FIG. 10